

Snowfall Rate Retrieval using NPP ATMS Passive Microwave Measurements

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Passive microwave measurements at certain high frequencies are sensitive to the scattering effect of snow particles and can be utilized to retrieve snowfall properties. Some of the microwave sensors with snowfall sensitive channels are Advanced Microwave Sounding Unit (AMSU), Microwave Humidity Sounder (MHS) and Advance Technology Microwave Sounder (ATMS). ATMS is the follow-on sensor to AMSU and MHS. Currently, an AMSU and MHS based land snowfall rate (SFR) product is running operationally at NOAA/NESDIS. Based on the AMSU/MHS SFR, an ATMS SFR algorithm has been developed recently. The algorithm performs retrieval in three steps: snowfall detection, retrieval of cloud properties, and estimation of snow particle terminal velocity and snowfall rate. The snowfall detection component utilizes principal component analysis and a logistic regression model. The model employs a combination of temperature and water vapor sounding channels to detect the scattering signal from falling snow and derive the probability of snowfall (Kongoli et al., 2014). In addition, a set of NWP model based filters is also employed to improve the accuracy of snowfall detection. Cloud properties are retrieved using an inversion method with an iteration algorithm and a two-stream radiative transfer model (Yan et al., 2008). A method developed by Heymsfield and Westbrook (2010) is adopted to calculate snow particle terminal velocity. Finally, snowfall rate is computed by numerically solving a complex integral. The ATMS SFR product is validated against radar and gauge snowfall data and shows that the ATMS algorithm outperforms the AMSU/MHS SFR.